



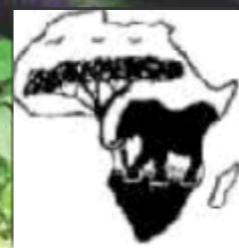
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# Nature & Faune

Volume 25, Issue 1



## *Climate Change Implications for Agricultural Development and Natural Resources Conservation in Africa*



**FAO Regional Office for Africa**



**Front Cover Photos:**

Top: Fiery sunset

Middle from left: Cattles die in the drought, Ethiopia; A coastal erosion in West Africa; A group of children in a queue to be fed, Mozambique; Parched agricultural field in Africa, anonymous.

Bottom: Gorilla family in Volcano National Park – Rwanda

**Back Cover Photos:** Farmers cultivating rice in Senegal

*Nature & Faune* is a peer-reviewed open access international bilingual (English and French) publication dedicated to the exchange of information and practical experience in the field of wildlife and protected areas management and conservation of natural resources on the African continent. *Nature & Faune* has been in wide circulation since 1985.

*Nature & Faune* is dependent upon your free and voluntary contribution in the form of articles and announcements in the field of wildlife, forestry and nature conservation in the Region.

**Editor:** F. Bojang

**Deputy Editor:** A. Ndeso-Atanga

**Advisers:** F. Salinas, A. Yapi, R. Czudek



# Nature & Faune

*Enhancing natural resources management for food security in Africa*

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## Climate change implications for agricultural development and natural resources conservation in Africa

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### Agriculture, climate change and nature in Africa

*Jeffrey Sayer<sup>1</sup>*

When I began working in Africa in the late 1960s the continent had a population of about 250 million. Since then the population has quadrupled and there are now over a billion Africans. During the intervening years agricultural yields per capita and per hectare stagnated and in many cases declined although the past ten years have seen promising signs of progress and the economies of the continent are now growing at around 3% per annum. Nonetheless the continent has the highest proportion of food insecure people of any region of the world (FAO 2010); the population is set to double again within a couple of decades and hundreds of millions of people still live from subsistence agriculture on farms that average two hectares but which are often much smaller. The challenge of feeding this growing population has to be met in a context of great uncertainty about future climates and without destroying the environment upon which all agriculture ultimately depends.

#### **Challenges and opportunities for Africa**

Much of Africa is arid and in general the soils are poor - yet many areas of Africa clearly do have enormous agricultural potential. In South America, Brazil is emerging as one of the world's agricultural powerhouses and much of its agriculture occurs in conditions that are not so different to those found in Africa. The Cerrado with its vast soybean plantations making Brazil the world's second largest producer of this important crop is remarkably similar to the vast Miombo woodland belt that runs across the width of Southern Africa. The floodplains of Africa's mighty rivers – the Nile, the Niger, the Senegal, the Zambezi etc – all have enormous untapped potential for irrigated agriculture. The forest zones of central and western Africa have great potential for tree crops ranging from the mixed tree crop systems of West Africa to the potential for very large plantations of oil palm in Congo Basin countries. There is untapped potential for industrial plantation forestry along the coasts of Angola and Mozambique. In theory Africa could be transformed from a food deficit continent to one of the world's major exporters of agricultural crops. The issue for environmentalists is that there are a number of different pathways for agricultural expansion in Africa and they each present different challenges and opportunities for the environment. These challenges have to be met in a context of increased climatic variability, higher temperatures and in general dryer climates in dry areas and wetter climates in those areas that are already wet. This context of climate change has major implications for whatever agricultural strategy is adopted.

Over the last three decades of the 20<sup>th</sup> Century the increase in world food production – even though it failed to keep pace with population growth – came from the Green Revolution in Asia and through the expansion of the area farmed elsewhere. In Africa

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large areas of forest and savannas were cleared for mostly low productivity agriculture. This was clearly the least good solution for the environment. Today there are still people who see area expansion as the solution to Africa's food problems. However, most environmentalists would see this as a major threat to Africa's remarkable biodiversity. Environmentalists would like to see increased production coming from better use of existing farmland. This means that people concerned with the conservation of nature in Africa have to give careful thought to the positions that they adopt in relation to different agricultural development pathways.

### **Biodiverse, organic agriculture for Africa**

UNEP is leading a number of environmental organisations with calls for organic approaches to agriculture in developing countries. The logic is that in the absence of reliable supplies of fertilizers, pesticides and fuel it will be safer for African farmers to invest their labour in locally self sufficient farming systems (UNEP-UNCTAD 2008; Action Aid and Food first 2009). These systems also have less harmful global environmental impacts. The Convention on Biological Diversity and CGIAR research centres like BIOVERSITY, ICRAF and CIAT argue that small scale biodiverse farming systems will be more sustainable and resilient – notably in confronting the challenges of climate change – than specialised high input agriculture. However the danger is that organic locally self-sufficient approaches may keep farmers living at a precarious subsistence level. Locally self-sufficient agriculture may not be effective at bringing about the transformational changes in the lives of poor farmers that most would agree are essential (Walker et al 2010). The Millennium Development Goals will not be met through the continued reliance of 70% of Africa's population on subsistence agriculture. The excellent report of the International Assessment of Agricultural Science and Technology for Development – the IAASTD – assesses the options and implications of different agricultural strategies but comes down on the side of multiple locally adapted solutions but also acknowledges the need for higher inputs and greater market access (IAASTD 2008, 2009). Low technology approaches to agricultural expansion will emit less greenhouse gases, may be more resilient to climate change, may be less impacted by the increasing scarcity of fertilizers and pesticides and less vulnerable to economic shocks but environmentalists should not forget that they will also consume more land than more intensive high technology agriculture.

### **Africa in the global market economy**

A more pragmatic approach is taken by the World Bank's 2008 World Development Report on agriculture (World Bank 2007). This notes that progress driven by economic forces. Improved policies, better infrastructure and greater access to markets would unleash the entrepreneurial potential of African farmers who would respond by intensifying their methods and using more agricultural inputs. Better farmers would expand their land holdings and economies of scale would be achieved. Under this scenario Africa could produce far more food without excessive further expansion into forests and wetlands and agriculture would become one of the motors of economic growth for the continent. The Association for a Green Revolution in Africa –AGRA - is investing heavily in activities which are consistent with this scenario, notably by helping to ensure availability, through the private sector, of improved seeds and fertilizers.. The World Development Report and AGRA approaches are attractive in the context where more and more African's move to cities and work in manufacturing and services. The economic surpluses that they produce would increase their purchasing power and drive



the intensification of small to medium farms. This scenario mimics what has happened in the developed world over the past century with fewer and fewer people involved in agriculture and a concentration of people in cities and more favourable agricultural areas. The emigration of people from rural areas might provide more favourable outcomes for the environment than the organic agriculture scenario that many environmentalists find ideologically attractive. This market driven scenario would require major policy changes implemented by African governments.

Another potential driver of major change in Africa is foreign investment in industrial scale agriculture in high potential areas. In principle such industrial schemes could produce enough food for Africa on a fraction of the land now under farms. The detractors of these schemes label them as “land grabbing” and fear that the investors would act like colonists and exploit Africa’s land and labour purely to meet the domestic objectives of the investing country. Some fear that such schemes might not even use African labour but might bring in large numbers of economic migrants thus creating foreign enclaves disconnected from local economies and exacerbating local food supply problems. In principle foreign direct investment in agriculture need be little different to foreign investment in manufacturing or services which are generally thought to be good for economies and - by alleviating poverty - good for the environment. The critical issue is the governance regime under which these mega-agriculture projects operate. If they create jobs, drive local economies and supply local markets then these schemes could concentrate agriculture in smaller areas and reduce pressures on the environment. A recent paper in this journal by Chipeta (2010) discusses these issues in more detail.

### **Dealing with Climate change**

So how might these different scenarios play out under climate change? Advocates of different strategies see advantages in their chosen pathway. Locally adapted, biodiverse, small scale agriculture might be expected to be resilient to change through reduced dependence on external inputs and through “not having all of its eggs in one basket”. The UNEP – IAASTD scenario would have farmers producing a wider range of crops, including more trees in their farming systems thus having more options in times of climate stress. However the danger is that farmers would remain poor and the poor are always the most vulnerable to the sorts of outside shocks that climate change will bring. Advocates of the higher input, larger production units and more efficient farming systems see farmers’ resilience to change coming from their ability to accumulate assets, store produce, purchase insurance and chemical inputs to deal with emerging threats.

### **Which scenario is best for the environment?**

The best recipe to enable African farmers to adapt to climate change may be to give them good education, technical skills, health care, infrastructure and access to markets. They will then be in a position to make their own choices about the agricultural strategies that best meet their needs. They will also be able to build up the capital that they need to deal with the climatic problems that will certainly afflict them. Farmers may be dependent on a single crop or on multiple crops but if they have the ability to accumulate capital in good times they will be better able to deal with the bad times when these occur (Walker et al 2010).

One reality that environmentalists have to face is that even if we favour one scenario over another we have little capacity to influence agricultural development pathways. We should welcome the attempts by UNEP and the IAASTD to make the links between agriculture and environment clear. The sorts of agriculture that these organizations recommend will be systems that sequester more carbon from the atmosphere, that emit less greenhouse gases and are in general more energy efficient – they are advocating low carbon, ecologically efficient agricultural development pathways. This must be set against the greater land needs for these sorts of agriculture than those for higher input intermediate scale or industrial agriculture.

The reality is that different agricultural development pathways will have a role to play in Africa's future in different parts of the continent and even the foreign mega-investments – the "land grabs" – seem certain to happen. Overall the situation is far from hopeless. Africa has enormous land resources, entrepreneurial and hard working farmers and if economic growth continues to accelerate then infrastructure and markets will provide the incentives for farmers to produce more and accumulate the assets that will enable them to weather the storms of climate change and economic shocks. Environmentalists should be cautious in resisting agricultural innovations that may have short term or local negative impacts on nature but which might provide better long-term options by jump starting the economic growth that people of the African continent so desperately need. Leaving a high proportion of the continent's rural people in poverty is the one outcome that will for certain destroy the environment. Africa needs economic growth, agriculture has the potential to be a motor for that growth and more efficient agriculture will in general be better for the environment than the continuation of the *status quo*. Prosperous farmers will be better able to adapt to climate change and variability than those that are locked into precarious subsistence systems. African governments have to consider all of the options open to them and put the rural farmers at the centre of their development agendas – in the past they have been far too preoccupied with subsidising urban populations. Ultimately African civil society needs to be empowered to pressure its governments to make and enforce the best decisions for the continent but the ability of civil society to assert itself will be much greater when people are prosperous and well fed.

## References

ActionAid & FoodFirst. 2009. Smalholder Solutions to Hunger, Poverty and Climate Change (<http://www.foodfirst.org/files/pdf/Solutions5.pdf>)

Chipeta, E. M. 2010. The new wave of large-scale land intensive foreign investment in African agriculture. *Nature & Faune* magazine, Volume 24, Issue 2.

FAO 2010. The state of Food Insecurity in the World. FAO, Rome Italy.

IAASTD - International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD). 2008. Global Report. ([www.agassessment.org](http://www.agassessment.org) and [www.iaastd.net](http://www.iaastd.net))

IAASTD - International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD). 2008. Global Summary for Decision Makers. ([www.agassessment.org](http://www.agassessment.org) and [www.iaastd.net](http://www.iaastd.net))

UNEP - UNCTAD. 2008. Organic Agriculture and Food Security in Africa. UNEP-UNCTAD Capacity-building Task Force on Trade, Environment and Development. ( [www.unep-unctad.org/cbtf/publications/UNCTAD\\_DITC\\_TED\\_2007\\_15.pdf](http://www.unep-unctad.org/cbtf/publications/UNCTAD_DITC_TED_2007_15.pdf) )

Walker, B., J.A. Sayer, N. L. Andrew, and B. Campbell. 2010. Should Enhanced Resilience Be an Objective of Natural Resource Management Research for Developing Countries?

Published online 5 March 2010; doi:10.2135/cropsci2009.10.0565.Crop Sci. 2010 50: S-10-S-19.

World Bank, 2007. World Development Report; Agriculture for Development. World Bank, Washington DC.